National Association of Medical Examiners Position Paper

Recommendations for the Documentation and Certification of Disaster-Related Deaths

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Abstract: Collecting and reporting accurate disaster mortality data are critical to informing disaster response and recovery efforts. The National Association of Medical Examiners convened an ad hoc committee to provide recommendations for the documentation and certification of disaster-related deaths. This article provides definitions for disasters and direct, indirect, and partially attributable disaster-related deaths; discusses jurisdiction for disaster-related deaths; offers recommendations for medical examiners/coroners (ME/Cs) for indicating the involvement of the disaster on the death certificate; discusses the role of the ME/C and non-ME/C in documenting and certifying disaster-related deaths; identifies existing systems for helping to identify the role of disaster on the death certificate; and describes disaster-related deaths that may require amendments of death certificates. The recommendations provided in this article seek to increase ME/C's understanding of disaster-related deaths and promote uniformity in how to document these deaths on the death certificate.

Key Words: disaster, disaster mortality, death certificate, preparedness

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Disaster mortality data are critical to making informed decisions throughout the disaster cycle, including preparedness, response, recovery, and mitigation. In particular, understanding why and how people die from disasters can help inform evidence-based response and prevention strategies to mitigate immediate and future disaster-related mortality. The frequency, severity, and intensity of disasters have increased over the past decades, resulting in significant mortality that is difficult and complex to capture.[1,2] The National Weather Service estimates there have been 1179 fatalities caused by tornados and hurricanes from 2010 to 2021.[3]

Disasters vary widely in scope and scale and may affect a community in a range of ways. Natural disasters (eg, weather-related disasters, wildfires, or landslides) and human-induced disasters (eg, radiation, bombings, or contamination of the environment) may overwhelm an area's capacity to mitigate effects and can have lasting impacts. The diverse categories of disasters and the complex ways they impact a community make creating generalizable procedures difficult. Understanding the scope of the impact of a disaster is vital to advise communities, states, and nations on how to become better prepared for disasters and prevent future mortality.[4]

Despite the importance of these data, there are still challenges that contribute to significant under-reporting of disaster-related deaths.[5] For example, one study that reviewed 446 out-of-state death certificates for Louisiana residents related to Hurricane Katrina classified 431 as indeterminate because "no indication of hurricane association was listed on the death certificate."[6] The study concluded that the final count of 15 out-of-state deaths among Louisiana Katrina evacuees was likely an undercount due to different criteria in identifying storm-related deaths in other states.[6] Improving the consistency of reporting the role of the disaster will lead to improved mortality surveillance and ultimately improved preparedness, response, and recovery systems to save lives. Medical examiner/coroner (ME/C) offices play critical roles in providing data for disaster-related mortality surveillance because of their responsibilities for investigating and certifying disaster-related deaths.

To address the inconsistencies and current limitations of guidance on disaster-related deaths for ME/C, the National Association of Medical Examiners (NAME) commissioned an ad hoc committee to provide recommendations for the documentation and certification of disaster-related deaths. This article provides recommendations and best practices to assist an ME/C jurisdiction as well as the public health and emergency management sectors of government to develop consistent practices. Medical examiners, coroners, medicolegal death investigators, and vital statistics experts collaborated on the expert panel to create definitions and recommendations for certifying disaster-related deaths. The goal of this article is to better inform decision-makers of the burden of disasters, both directly and indirectly and from a local to a national level, and improve surveillance to determine the effectiveness of protecting people from disasters.

METHODS

The Committee developed a list of research questions (Table 1) for defining disasters and disaster-related deaths, assuming jurisdiction of the death investigations, and certifying disaster deaths. The

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TABLE 1. Research Questions Addressed by This Position Paper

Category	No.	Research Question
Defining a disaster	1	What is the definition of a disaster within the context of death certification?
Direct vs indirect deaths	2	What disaster-related deaths are classified as direct? What disaster-related deaths are classified as indirect? What disaster-related deaths are classified as partially attributable or possibly related?
Jurisdiction	3	When does the law allow ME/C to assume jurisdiction in cases of disaster?
Certification	4	How should disaster-related deaths be captured on the death certificate?
	5	What is the role of the ME/C in certifying deaths in a disaster?
	6	What is the role of non-ME/C in certifying indirect disaster-related deaths?
	7	What systems do states have in place to indicate the involvement of a disaster on the death certificate
	8	When is it necessary and appropriate for ME/C to amend death certificates to mention the involvement of a disaster?

Committee reviewed peer-reviewed literature, publications from government and multinational agencies, and documents from ME/C offices to identify relevant information about disaster-related deaths. To identify relevant articles, the Committee (1) reviewed the literature cited by the 2020 National Academies of Sciences, Engineering, and Medicine (NASEM) report, *A Framework for Assessing Mortality and Morbidity After Large-Scale Disasters*,[7] (2) worked with a librarian from the Centers for Disease Control and Prevention (CDC) to generate search terms and identify additional articles through a literature search, (3) issued a call for resources and materials through the NAME listserv, and (4) conducted targeted searches to answer questions as they emerged. The search terms and databases used for the literature search are included in Appendix B. Committee members reviewed identified articles and resources to determine if they addressed a research question and should be included as a citation for this article.

The Committee limited the scope of the article to documentation and certification of disaster-related deaths. The scope of this article does not include war-related deaths, disaster victim identification (discussed in the "NAME position statement on disaster victim identification in mass fatality incidents" and the "2021 NAME standard operating procedures for mass fatality management"), opioid-related deaths (discussed in the "NAME position paper recommendations for the investigation, diagnosis, and certification of deaths related to opioid and other drugs"), or disaster scene investigation (discussed in the CDC's "Death scene investigation after natural disaster or other weather-related events toolkit").[8–11]

DEFINITION OF A DISASTER WITHIN THE CONTEXT OF DEATH CERTIFICATION AND JURISDICTION OVER THE DISASTER DECLARATION

Defining a Disaster

The word "disaster" is often used to describe a scenario that has caused some level of turmoil, damage, illness, injury, or death.[1,4,12–14] From a legal perspective, governments may seek to formally declare an incident as a "disaster" when the incident causes disruption to life in a single municipality, in multiple regions, in counties, in states, or nationally and exceeds the local capacity to manage. Definitions of the word "disaster" for governmental purposes typically include language that states a person in an executive role has authority and responsibility to declare an event or incident as a disaster. Formally declaring a disaster helps a local or state government to access needed resources to protect life, property, and public health and help respond to the incident. This article makes a distinction between the following terms:

- Mass fatality incident: NAME defines a mass fatality incident as any incident resulting in more decedents to be recovered and examined than can be managed in the local ME/C jurisdiction.[8]
- Disaster: CDC defines a disaster as serious disruption of the functioning of society, causing widespread human, material, or environmental losses, that exceeds the local capacity to respond and calls for external assistance.[4] Different agencies and jurisdictions may use different definitions for disasters or related terms, such as a "catastrophic incident."[a] Not all bad weather-related events will meet the definition of a disaster.
- Formally declared disasters: Disasters can be declared by local or state governments or by the federal government. At the federal level, the Governor of the affected state formally asks the President to declare a major disaster through the appropriate Federal Emergency Management Agency (FEMA) Regional Administrator, as defined by the 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act, 42 US Code 5121 et seq).[15] The Stafford Act allows for both "emergency" and "major disaster" declarations. Medical examiners/coroners should be aware of their own state or jurisdictional definition for formally declaring a "disaster" or similar terms, such as "state of emergency" or "public health emergency."

Medical examiner/coroner response capabilities will depend on the scale of the disaster and the number of fatality incidents associated with the disaster.[16] A 2014 study of 122 ME/Cs showed that some ME/Cs might be overwhelmed by any additional deaths that surpass their typical number of cases.[17] The study also found that 42% of respondents would be overwhelmed by 24 or fewer additional fatalities over a 48-hour period.[17] The Committee developed a continuum of fatality incidents to help conceptualize the extent to which a disaster may overwhelm an ME/C office (Fig. 1), based on the level of disruption in normal activities in the locality and the number of deaths that occur because of a disaster.

Types of Disasters

Disasters may include natural phenomena, such as hurricanes, tornados, floods, and wildfires, or human-induced events such as radiation or bombings (Table 2).[4,18,19] Disasters may also include infectious disease events, such as the global COVID-19 pandemic and incidents of bioterrorism.[20,21] Medical examiner/coroner offices should remain in close contact with their respective governmental offices, such as the department of public safety and/or office of emergency management, to track formal disaster declarations. An ME/C office may be asked to provide data to help the jurisdiction's executive make the decision to declare a disaster. Deaths from disasters often occur before any formal declaration

[a] As defined by 6 US Code § 311, a catastrophic incident means "any natural disaster, act of terrorism, or other man-made disaster that results in extraordinary levels of casualties or damage or disruption severely affecting the population (including mass evacuations), infrastructure, environment, economy, national morale, or government functions in an area."

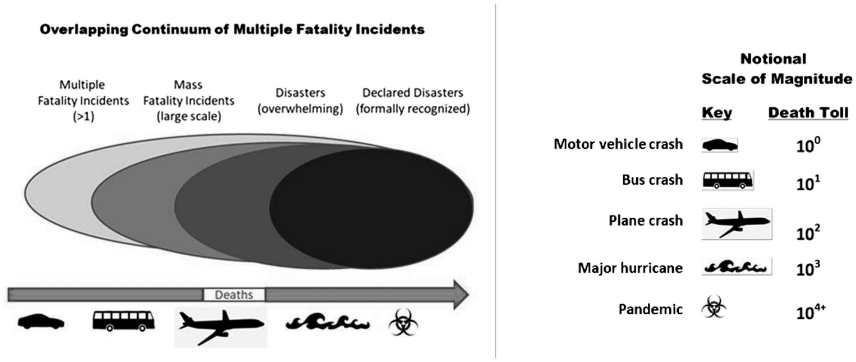


FIGURE 1. Overlapping continuum of multiple fatality incidents.

occurs. Medical examiner/coroner offices should be aware of such instances and anticipate such a declaration.

DIRECT, INDIRECT, AND PARTIALLY ATTRIBUTABLE DISASTER-RELATED DEATHS

Direct and Indirect Disaster-Related Deaths

Direct disaster-related deaths are those attributable to the forces of the disaster or by direct consequences of these forces, such as structural collapse, health and body trauma, and other factors.[4] For example, of the 235 deaths associated with the Alabama Tornado Outbreak on April 27, 2011, 95% were direct disaster-related deaths.[22] The most reported direct mechanisms of death were being struck by debris or objects (47.7%), thrown (34.5%), and crushed (18.7%), and the most common cause of death on the death certificate was trauma (90.3%). Direct disaster-related deaths are typically categorized as nonnatural deaths.[7]

Indirect disaster-related deaths occur because of unsafe or unhealthy conditions present directly before, during, or after a disaster (during the recovery phase). Indirect deaths can be precipitated by multiple factors, including preparation for a disaster, vehicle accidents, evacuation, medical equipment outages, and cleanup activities, among many other causes. For example, there were an estimated 133 storm-related carbon monoxide poisoning deaths in Connecticut between October 2011 and 2012, mostly due to the use of generators or charcoal.[23] Indirect disaster-related deaths may be natural or nonnatural deaths.[7] Table 3 provides definitions and examples of direct and indirect disaster-related deaths, and Figure 2 describes additional contributing factors that lead to indirect disaster-related deaths.

Partially Attributable/Possibly Related Disaster-Related Deaths

Some documents refer to a third category of disaster-related death. The NASEM's *A Framework for Assessing Mortality and Morbidity After Large-Scale Disasters* states that disaster-related deaths can be direct, indirect, or partially attributable, which are deaths that "cannot be definitively tied to the disaster, but where the disaster more likely than not has played a contributing role in the death."[7] A stress-induced cardiac event in a patient with preexisting atherosclerosis during a disaster might be considered a partially attributable death. Studies of disasters have also discussed "possibly related" deaths.[19,24–27] For example, one study of deaths associated with Hurricane Katrina classified deaths as possibly related when "(1) the death occurred in the hurricane-affected area during August 23 to October 23, 2005, (2) the cause or manner of death was undetermined or pending, and (3) reviewers agreed that a possible relation between the death and the hurricane might exist."[25] Although these third categories of disaster-related deaths are discussed in the literature, the Committee is not suggesting the general adoption of usage of partially attributable or possibly related. Medical examiner/coroner offices should review NASEM's case definition for partially attributable deaths and decide whether to adopt its use.

Timeline of Disaster-Related Deaths

Deaths from a disaster may occur days, weeks, months, or years after the disaster incident. For example, indirect deaths can occur days before or weeks after hurricanes, such as during preparation or clean up from the event.[6,27–29] Deaths from acute radiation syndrome, associated with disasters like nuclear power plant

TABLE 2. Examples of Potential Disasters

Examples of Natural Disasters	Examples of Human-Induced Disasters
• Avalanche, mudslide, landslide	• Bioterrorism
• Blizzard (snowstorm), nor'easter, ice storm	• Bombing
• Dust storm, sandstorm	• Building collapse
• Earthquake	• Chemical or biological contamination of environment
• Extreme temperature (heat wave/cold wave)	• Industrial explosion or chemical release
• Floods	• Mass shootings
• Tropical cyclones (ie, hurricane, typhoon)	• Radiation
• Storm surge, tidal wave caused by tropical cyclone	• Transportation incident
• Tornados	
• Tsunami, tidal wave caused by earthquake	
• Volcanic eruption	
• Wildfire or firestorm	

TABLE 3. Direct and Indirect Disaster-Related Deaths (Adapted From CDC's *A Reference Guide for Certification of Deaths in the Event of a Natural, Human-Induced, or Chemical/Radiological Disaster*)[4]

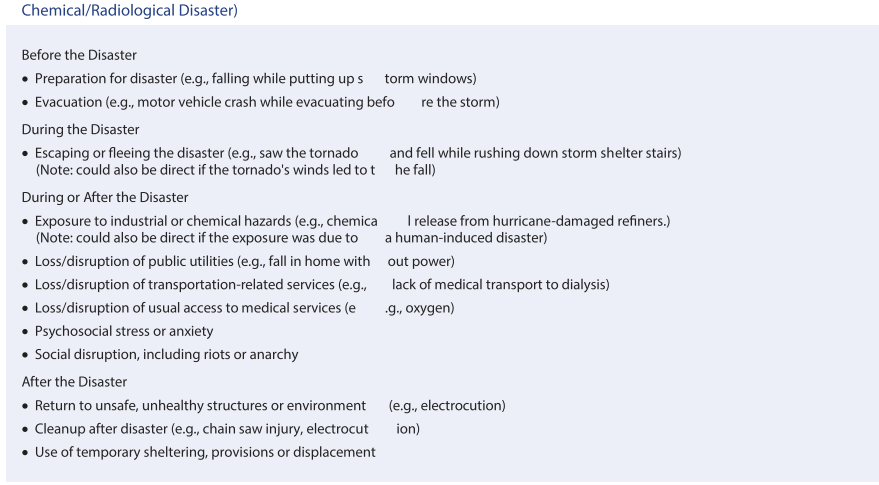
Type of Death	Definition	Examples of Cause of Death	Questions for ME/C and Other Certifiers
Direct deaths	Deaths directly attributable to the forces of the disaster or by the direct consequences of these forces, such as structural collapse, head and body trauma flying debris, or radiation or chemical exposure. Other direct consequences include drowning in floodwaters, heatstroke from heatwaves, and gunshot wounds from mass shootings.	• Burns • Crushing • Drowning • Electrocution • Falls • Fire/smoke inhalation • Hyperthermia (heat) • Hypothermia (cold) • Radiation/chemical poisoning • Suffocation • Traumatic injury • Blunt force trauma • Penetrating injury	• Was the death caused by the actual environmental forces of the disaster such as wind, rain, floods, earthquakes, or blast wave or by the direct consequences of these forces, such as structural collapse, chemical spill or flying debris?
Indirect deaths	Deaths that occurred due to unsafe or unhealthy conditions present during any phase of the disaster (preevent or preparing for the disaster, during the disaster event, or postevent during cleanup after a disaster).	• Fatal injury occurring during cleanup • Electrocution and carbon monoxide poisoning after storms • Exacerbation of chronic condition due to inability to access medical care, obtain medication, or failure of home medical equipment	• Did unsafe or unhealthy conditions from the environmental forces of the disaster contribute to the death? • Did the forces, whether natural or human-induced disaster, lead to temporary or permanent displacement, property damage, or other personal loss or stress that contributed to the death?

accidents, may occur months or years after the exposure.[30] The List of World-Trade Center-Related Conditions also includes multiple types of cancer that may take years to develop.[31] While an official "count" of disaster-related death may be restricted to a time period, the ME/C decision of whether a death is related to a particular disaster should follow the principles of death certification and not be limited to a specific time period.

THE ABILITY OF ME/C TO ASSUME JURISDICTION IN CASES OF DISASTER

State statutes, policies, and local customs mandate which deaths come under the purview of the ME/C. Many laws governing investigation and autopsy of deaths may require or enable an ME/C to assume jurisdiction during a disaster (Table 4).[32,33] These include certain manners of death (eg, accident, homicide), circumstances (eg, found dead at home), and causes of death (eg, drowning). Laws that require ME/C to investigate deaths that result from a disease posing a threat to public health and unattended deaths are particularly relevant to deaths related to COVID-19. It is important that the local ME/C understand the local laws and rules governing their jurisdiction in disaster situations.

As the geographic area, number of decedents, and number of government agencies involved increase, jurisdiction of cases becomes more complicated. Each entity has its respective assigned role to complete regarding investigation, rescue and recovery,


Chemical/Radiological Disaster)

Before the Disaster
- Preparation for disaster (e.g., falling while putting up s torm windows)
- Evacuation (e.g., motor vehicle crash while evacuating befo re the storm)

During the Disaster
- Escaping or fleeing the disaster (e.g., saw the tornado and fell while rushing down storm shelter stairs) (Note: could also be direct if the tornado's winds led to t he fall)

During or After the Disaster
- Exposure to industrial or chemical hazards (e.g., chemica l release from hurricane-damaged refiners.) (Note: could also be direct if the exposure was due to a human-induced disaster)
- Loss/disruption of public utilities (e.g., fall in home with out power)
- Loss/disruption of transportation-related services (e.g., lack of medical transport to dialysis)
- Loss/disruption of usual access to medical services (e .g., oxygen)
- Psychosocial stress or anxiety
- Social disruption, including riots or anarchy

After the Disaster
- Return to unsafe, unhealthy structures or environment (e.g., electrocution)
- Cleanup after disaster (e.g., chain saw injury, electrocut ion)
- Use of temporary sheltering, provisions or displacement

FIGURE 2. Additional contributing factors that lead to indirect disaster-related deaths (adapted from CDC's *A Reference Guide for Certification of Deaths in the Event of a Natural, Human-induced, or Chemical/Radiological Disaster*).[4]

TABLE 4. Number of States With Laws That May Affect the Ability of ME/C to Assume Jurisdiction in Cases of Disaster

Selected Characteristics of Deaths Requiring Investigation That May Affect Disaster-Related Deaths (Based on State Laws Enacted Before January 31, 2013)	No. States With Relevant Laws
Intent/manner of death	
Accident/casualty	41
Violence	38
Homicide	28
Circumstances	
Suspicious/unusual/unnatural	44
Suddenly when in apparent good health (under this age)	35
At home/found dead	8
Health or health care related	
Unattended by physician	30
Within 24 h of hospital/medical facility admission or if DOA	10
Cause of death	
Death may constitute threat to public health	27
Poisons/drugs/toxic agents	20
Employment related	19
Thermal/chemical/radiation/electrical	14
Fire/explosion	9
Drowning	9
Characteristics of the body	
Unidentifiable/skeletal/suspected human remains	15

The table is based on information about selected characteristics of death requiring investigation by state. Analysis was performed in February to May 2013 on laws current as of January 31, 2013. Analysis is based solely on statutory and regulatory language and does not examine application or implementation of the referenced laws.

documentation, and reporting. These roles and responsibilities may have considerable overlap during a response, and coordination between agencies is essential to overall disaster response and management.

CAPTURING DISASTER-RELATED DEATHS ON THE DEATH CERTIFICATE

Death certificates provide critical information about how and why people die before, during, and after a disaster. Standardizing the reporting of disaster-related deaths on the death certificate is essential to public health prevention, surveillance, and preparedness efforts. Accurately capturing the role of the disaster on the death certificate also has implications for benefits and resources available to the impacted families of the decedents. For example, the eligibility criteria for FEMA funeral assistance state the applicant needs "an official death certificate that clearly indicates the death was attributed to the emergency or disaster, or a signed statement from a medical examiner, coroner, or other certifier, attributing the death to the emergency or disaster, either directly or indirectly."[34,35]

Types of Disaster-Related Deaths

Disasters may be associated with various causes of death, and a single disaster event may result in a range of types of deaths.[36–42] For example, deaths related to Hurricane Isabel in Virginia in 2003 included 12 direct deaths (drowning and head injuries from falling trees) and 20 indirect deaths (including injuries sustained from motor vehicle accidents, falls, and power outages).[29] The manner of death in disasters also depends on the cause of the disaster. Generally, deaths related to natural disasters would be accidents, whereas deaths associated with terrorism would likely be homicides.

Identifying the Role of the Disaster on the Death Certificate

Depending on the type of death, it may be appropriate to note the involvement of the disaster in the Cause of Death (part 1), Other Significant Conditions Contributing to Death (part 2), or the "Describe How Injury Occurred" box. The CDC's *A Reference Guide for Certification of Deaths in the Event of a Natural, Human-induced, or Chemical/Radiological Disaster* provides specific guidelines to assist ME/C with identifying the role of the disaster on the death certificate.[4] The Committee recommends including the disaster by name on the death certificate when possible. If the disaster is not specifically named, such as in a snowstorm, the Committee recommends that death certifiers consider using the date to assist in future surveillance efforts. Table 5 provides examples of how to name the disaster or date on the death certificate (developed by the Committee). The Committee notes that the effects or aftermath of disasters may still cause deaths even after the disaster is "downgraded." For example, Hurricane Harvey was downgraded to a tropical storm when rain associated with the event caused extensive flooding in Texas. In these cases, the Committee still recommends including the name of the storm, for example, "Tropical Storm Harvey," to capture the full impact of the disaster event.

The Committee recommends reporting the disaster was a factor in the How Injury Occurred box when possible. However, when the manner of death is natural, certifiers may not be able to use the How Injury Occurred and Location of Injury sections of the death certificate to communicate the place and circumstance of the injury. As a result, natural deaths due to a disaster may be lost to public health and statistical inclusion. Therefore, until the death certificate is modified to allow for brief descriptions surrounding the death circumstances for all deaths regardless of the manner of death and/or the development of a check box to

TABLE 5. Examples of Disaster-Related Information to Include on the Death Certificate

History	Cause of Death (Part 1)	Other Significant Conditions (Part 2)	How Injury Occurred	Manner
A woman experiences a myocardial infarction during a tornado outbreak. Emergency services are delayed due to road blockages. She has an underlying diagnosis of atherosclerotic cardiovascular disease.	Acute myocardial infarct due to atherosclerotic cardiovascular disease	Road blockages due to April 2011 tornado delaying emergency response		N
A facility caring for elderly people in close proximity to a major wildfire experiences power outages that cause malfunction of oxygen generators. A woman dies after lack of access to oxygen. She had underlying diagnoses of end-stage idiopathic pulmonary fibrosis.[a]	Sequelae of idiopathic pulmonary fibrosis		Hypoxemia related to non-operational oxygen generator during power outage caused by 2018 Camp Fire	A or N or H
A man died from acute myocardial infarction in the hospital after a severe winter storm. The man experienced a myocardial infarction while shoveling snow. The man had a history of coronary artery disease (CAD) and hypertension.[b]	Acute myocardial infarct due to atherosclerotic cardiovascular disease	Exertion shoveling snow during the Jan 31, 2022 snowstorm		N
A man died in his car during a hurricane. The man drove into deep standing water, and his car filled with water as the roadway flooded.	Drowning		Car drove into flooded roadway after Hurricane Ida	A
A woman died in a house fire during a declared disaster for severe winter weather. The house had no power, and the occupants were using a gas stove to heat the home.	A. Smoke inhalation and thermal cutaneous burns B. House fire		Succumbed during house fire following Texas 2021 Winter Storm	A
A construction worker died during cleanup efforts for a hurricane.	Heat stroke due to exposure to environmental heat		Succumbed during cleanup of Hurricane Harvey	A
A man sustained a spinal cord injury during a bombing and died several months later after a prolonged hospitalization.	Urosepsis due to paraplegia due to blunt trauma of the torso with spinal cord injury		Crushed by falling debris during the Oklahoma City bombing	H

A, accident; H, homicide; N, natural.

[a]At the certifier's discretion and depending on the cause of the fire—if natural, the information in How Injury Occurred would go in part 2.

[b]This example may be considered an indirect disaster-related death if it occurs during a declared disaster. In some jurisdictions that regularly receive large volumes of snow, this death may not be considered disaster related.

ensure complete capture of all deaths in a disaster (discussed in Section 8), it is recommended that part 2 be used to communicate the involvement of the disaster, which is consistent with CDC guidance on certifying disaster-related deaths. Table 5 also provides examples of how to use part 2 to indicate the role of the disaster for natural deaths.

Federal, state, and local agencies may also issue guidance about how to certify deaths related to specific disasters, such as the COVID-19 pandemic.[43–45] For example, the Maricopa County Office of the Medical Examiner issued guidance stating that deaths are not indirectly related to the COVID-19 pandemic unless there is positive evidence that the death passes the "but for the pandemic coronavirus" response, such as in the case of an overdose on medication presumed to protect health from COVID-19 (Jeff Johnston, MD, personal communication).

Capturing Occupational Disaster-Related Deaths on the Death Certificate

There is a check box on the death certificate that allows the death certifier to indicate whether the death was related to an injury at work. Disasters may involve occupational-related disaster deaths. For example, wildfires may result in fatalities related to firefighting among firefighters.[46] Deaths related to hurricanes include fatalities that occur during cleanup and reconstruction, which may occur while at work long after the initial incident.[46] However, there might be ambiguity as to whether a death occurred "at work" for indirect disaster-related deaths. For example, a first responder might experience a heat-related death at home after working at a disaster site or be exposed to significant airborne particles that trigger an asthma exacerbation. Tracking deaths among these cohorts who develop long-term health impacts is difficult, and understanding these deaths requires careful consideration and then documentation by medical professionals. Similarly, injuries sustained in the response that are not immediately fatal, but rather result in a protracted hospitalization or have life-altering consequences (ie, paraplegia, traumatic brain injury, seizures), present difficulty tracking long term. When possible and relevant, the Committee recommends that the name of the disaster and the occupation of the decedent be described in part 2 or the "Describe How the Injury Occurred" box (Table 5).

THE ROLE OF THE ME/C IN CERTIFYING DEATHS IN A DISASTER

The role of the ME/C is to investigate and determine the cause and manner of death on all cases meeting their jurisdictional requirements as defined by state law and complete death certificates in a timely manner to accurately reflect their determination. To carry out these responsibilities, ME/C might engage in a variety of activities related to the identification and certification of disaster-related deaths:

- Operationalize a Continuity of Operations Plan to ensure ME/C office is able to continue investigating disaster-related deaths and issuing death certificates in the face of a disaster due to power failure or forced relocation.[47,48]
- Coordinate information with local, state, and federal emergency response agencies, public health, health services, vital records, law enforcement, and funeral homes.
- Coordinate investigation of circumstances with law enforcement, emergency medical services, and other emergency managers.
- Decide if a physical or virtual autopsy is needed (triage function) and work with a forensic pathologist to perform autopsies or, at minimum external examinations, to document trauma and other significant findings that lead to the conclusion of cause and manner of death.
- Request ancillary testing if necessary, such as toxicology and histology.
- Ensure victims are identified and those identifications are reflected on the death certificate.[49]
- When required by statute, notify the next of kin and preserve personal property.
- Accurately capture cause and manner of death on the death certificate, along with the details about the incident and injury.

Because of the length of time required to collect necessary data to determine the cause of death, ME/C may require weeks or months to reach a final conclusion. Deaths indirectly related to disasters may pose additional challenges, as the information needed to make this determination may not be readily apparent. Natural or human-induced disasters with multiple fatalities may overwhelm the ME/C because of the increased number of decedents in addition to their office's regular caseload. This can be especially true if the ME/C office is involved in the recovery and subsequent storage of remains. Recovery and identification of remains from disasters can also take a prolonged time; the identification of remains in New York City from the World Trade Center attacks on 9/11 continues 20 years later, and a decedent from the January 2018 landslides in California was identified over 3 years after the event.[50,51]

In addition to needing to identify decedents and determine the cause and manner of death on unknown deaths, there is still a role for the medicolegal death investigation authority in certification of known deaths that might not otherwise fall within their regular workload. There are natural deaths that would normally not fall within an ME/C's criteria that could be indirectly related to a disaster. This could include a patient with chronic disease who loses medical support because of a power outage, a patient who is unable to get to a medical facility for treatment, or a chronic condition exacerbated by disaster conditions. It is recommended that the ME/C make themselves available to review natural deaths to assess for indirect deaths when possible. The ME/C can work with the health department or directly with physicians signing the death certificate to add, or possibly remove, information capturing the disaster on the death certificate (such as adding loss of oxygen concentrator during Hurricane Ida to part 2) or may do amendments to reflect this review and subsequent decision. An ME/C is well versed in signing death certificates and understanding the nuances related to causal sequence for cause of death, and this experience can be applied to reviewing deaths during a disaster to make a consistent determination within the jurisdiction.

THE ROLE OF NON-ME/C IN CERTIFYING DISASTER-RELATED DEATHS

Many disaster-related deaths may happen in health care settings where an ME/C is not typically involved in certifying the death. These non-ME/C certifiers may include other physicians, registered nurses, nurse practitioners, and physician assistants.[52] Indirect disaster-related deaths in hospitals, nursing facilities, and homes may be certified as natural and never referred to the ME/C's office for review. Under ideal circumstances, the non-ME/C certifier will refer disaster-related deaths to the ME/C office for review, which will promote uniformity and consistency in certification of these deaths.

However, in some cases, these deaths may not be referred to the ME/C office. Therefore, the Committee also recommends that ME/C reach out to medical associations, hospitals, and other facilities (eg, hospice agencies) in their community to disseminate information about how to properly certify direct and indirect disaster-related deaths and the importance of including the disaster information in relevant death certificates. Ideally, this would be done as part of disaster preparedness, as well as with a reminder at the onset of such a disaster, which could also include a reminder built into the electronic death registration system (EDRS) (discussed in Section 8). These non-ME/C death certifiers should be encouraged to identify indirect deaths and include specifics on the death certificate to reflect the disaster involvement. Non-ME/C certifiers should also be informed as to what role they may need to play in final death certification after the ME/C review, such as if they should consult with the local MDI jurisdiction or if they will be requested to add the disaster information on the death certificate.

The Committee also emphasizes that ME/C offices should encourage non-ME/C certifiers to reach out the ME/C or vital statistics office with any questions. Medical examiner/coroner offices should also update their websites with guidance for disaster-related death certification that could address any frequently asked questions.

SYSTEMS STATES HAVE IN PLACE TO INDICATE THE INVOLVEMENT OF A DISASTER ON THE DEATH CERTIFICATE

Existing Systems for Disaster-Related Death Certification

After registration of death certificates occurs at the state and local level, vital records jurisdictions share death certificate data with CDC's National Center for Health Statistics (NCHS) to create national vital statistics files, which includes NCHS assignment of *International Classification of Diseases, Tenth Revision* (*ICD-10*) cause-of-death codes.[53] The NCHS provides the US Standard Certificate of Death to promote standardization and uniformity in data collection.[54] Vital records jurisdictions may elect to add fields to their jurisdiction death certificate contingent on state laws and rules. Death certificates may be filed manually on paper or reported electronically through an EDRS. Many vital records jurisdictions use their EDRS to also capture minimal data on a temporary basis without having to revise their certificates.[7] This capability is particularly useful during times of disaster to capture situation-specific data to help inform public health response. Since the US Standard Certificate of Death does not contain a

specific disaster-related data item, some states use their EDRS to specify whether a death was disaster related, such as by using flags (eg, checkboxes or dropdowns) for medical certifiers to indicate if a death meets some specific criteria (eg, related to a named disaster—yes, no, unknown). Electronic death registration system flags can help cast a wider net in identifying disaster-related deaths.[55,56]

Challenges With Existing Systems for Disaster-Related Death Certification

Active disaster mortality surveillance during or immediately after the disaster based on death certificates alone may be limited by jurisdiction statutory timeframes for death registration, which vary and may not provide information in time for immediate disaster response. States like Texas, Kentucky, and North Carolina have conducted active disaster surveillance through their public health departments using a disaster-related mortality surveillance form.[57–59] The form captures similar information to a death certificate, regarding demographics, cause and circumstances of death. The EDRS and disaster-related mortality surveillance form both help identify disaster-related deaths for local tracking and surveillance.[55–57] However, lack of uniformity in data collection within and across jurisdictions poses challenges for comparative analysis and capturing important information about deaths during a disaster.[7] For instance, states that use an EDRS for disaster mortality surveillance may use different or imprecise case definitions for disasters.[7] In addition, some states are still transitioning to electronic reporting of all death certificates, and not all jurisdictions with an existing EDRS maximize its functionality for disaster-related death reporting.

Critically, states cannot solely use EDRS flags and active mortality surveillance systems in place of indicating the role of the disaster on the death certificate.[55] In order for a death to be *ICD* coded as disaster related in national vital statistics, the specifics of the disaster must be described in the cause-of-death statements, which are free text fields on the death certificate.[4] If the disaster is not specified on the death certificate, the death will not be counted as disaster related. Although this position paper seeks to improve uniformity with using these free text fields to identify disaster-related deaths, there are still challenges with disaster-related data collection. For example, because of the media convention of naming disasters with taglines (ie, Pulse Nightclub), certifiers may use different names in the cause-of-death statements when addressing the same incident. In addition, non-ME/C may not have the necessary training to indicate the involvement of the disaster in the cause-of-death statements.

Recommendation for Updating the US Standard Certificate of Death

The current US Standard Certificate of Death does not offer a specific item to capture disaster-related death information. The cause of death, contributory conditions, and how injury occurred free text fields are the only places this information can be documented, and they is not done with consistency. To ensure disaster-related deaths are properly identified on the death certificate, we need a specific disaster-related data item. This data item should appear on both the electronic and paper forms to ensure surviving family members can gain access to potential FEMA funeral benefits. Because accurate disaster-related death documentation is of importance on the local, state, and national levels, it is this Committee's recommendation to add a Yes, specify_____/No/Unknown disaster-related data field to the US Standard Certificate of Death. This would ensure that all vital records jurisdictions in the United States collect this information and that the information is part of the official death record (both paper and electronic), available for proper *ICD-10* coding and compiled appropriately with national vital statistics. This field would also prompt the non-ME/C certifier to consider whether the death is disaster related, thereby flagging them for potential ME/C and vital statistics review.

THE NECESSITY AND APPROPRIATENESS OF AMENDING DEATH CERTIFICATES TO ACKNOWLEDGE THE INVOLVEMENT OF A DISASTER

The cause of death is a medical opinion, and this conclusion may be changed or amended should additional and relevant information or material become available.[54,60] The process for amending a cause of death will vary by state and jurisdiction.[61] For example, in Wisconsin, the certifying physician may amend a cause of death for up to 1 year after death pronouncement without requiring a court order.[60] New information or material may include medical or forensic science developments that may provide justification for a cause or manner of death reclassification.[54] For example, one study found that 3.37% of certificates from the Broward County Medical Examiner's Office were amended from

TABLE 6. Final Recommendations for Documentation and Certification of Disaster-Related Deaths

Recommendations for ME/C Offices
- Describe the disaster by name on the death certificate when possible.
- If the disaster does not have a formal name, provide the date and disaster type on the death certificate.
- Provide case definitions for direct, indirect, and partially attributable deaths.
- Review death certificates issued during declared disasters to assess for indirect deaths for uniformity and consistency.
- Reach out to medical associations, hospitals, nursing homes, and funeral homes to disseminate information about how to properly certify deaths related to a disaster and the importance of including the disaster in relevant death certificates.
- Create a procedure for considering amendments for death certificates related to disasters.
- Develop a Continuity of Operations Plan for the office to ensure for continued death certification during disaster situation.
- Update website with information about the essentials of disaster-related death certification.

Recommendations for non-ME/C Certifiers
- When questions arise when certifying deaths during declared disasters, refer the death to the ME/C's office.

Recommendations for vital statistics
- Add a specific disaster-related data item on the US Standard Certificate of Death (Yes, specify_____/No/Unknown) for better documentation of disaster-related deaths.
- Update website with information about the essentials of disaster-related death certification.
- For EDRS that use flags for disaster-related deaths, put the definitions for direct and indirect deaths in the system with instructions to inform the ME/C if the death fits into those categories.

2006 to 2007, with 35% of amendments related to additional toxicology findings.[62]

Amending Disaster-Related Death Certificates

The death and analysis of Felicia Dunn-Jones in the wake of 9/11 placed death certificate amendments after disasters in the spotlight.[63] Dr Charles Hirsch, then the Chief Medical Examiner of New York City, amended Dunn-Jones's death certificate to reflect that exposure to dust from the collapsed World Trade Center buildings was contributory to her death and accelerated her lung disease, thereby changing the manner of death from natural to homicide.[63] Depending on the size and scale of the disaster, coordinated and government-funded efforts may be necessary to establish guidelines for death certification and amendments, such as those established by the World Trade Center Health Registry.[64] The Registry investigates evolving science and data and establishes lists of health conditions covered by the World Trade Center Health Program. Amendments may also be common for deaths from pandemic disasters, such as COVID-19. For example, the Pennsylvania State Registrar instructs certifiers that death certificates should not be delayed for pending COVID-19 test results and that amendments may be submitted if laboratory testing confirms the presence of COVID-19.[45]

The COVID-19 pandemic also highlights how the availability of resources and available science play a role in death certification and amendments, including when they affect eligibility for funeral benefits. Surveillance periods will need to be flexible and reassessed so that decedents eligible for disaster-related death certification will be counted accordingly, and the fatalities will not be underestimated.

When considering amendments, the issue of jurisdiction must be considered. As noted above, the cause and manner of death are opinion. When disasters involve large geographic areas, or multiple scenes, there may be multiple medicolegal authorities involved. Whenever practical, medicolegal authorities should coordinate response efforts and devise a standardized procedure for certifying deaths and considering amendments.

FINAL RECOMMENDATIONS

Table 6 lists the recommendations described in this position paper.

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